10088094 .061302

Rec'd PCT/PTO 21 MAR 2002

ATTORNEY'S DOCKET NO: 020312

U.S. DEPARTMENT OF COMMERCE, PATENT AND TRADEMARK OFFICE		DATE: **March 21, 2002**
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLN. NO. (if known): 10/088094
INTERNATIONAL APPLICATION NO.: **PCT/JP00/06004**	INTERNATIONAL FILING DATE: **SEPTEMBER 4, 2002**	PRIORITY DATE CLAIMED: **SEPTEMBER 21, 1999**

TITLE OF INVENTION: ***DYNAMIC OPTIMIZATION METHOD FOR SPEED DATA AND POSITIONING DEVICE USING THIS METHOD***

APPLICANT(S) FOR DO/EO/US: **Youichi HASHIMOTO**

Applicant hereby submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. X This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ___ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. X This express request to begin national examination procedures (35 USC 371(f)) at any time rather than delay examination until the expiration of the time limit set in 35 USC 371(b) and PCT Articles 22 and 39(1).

4. X A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. X A copy of the International Application as filed (35 U.S.C. 371(c)(2)):

   a. ___ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. X has been transmitted by the International Bureau.
   c. ___ is not required, as the application was filed in the United States Receiving Office (RO/US)

6. X A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. X Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))

   a. ___ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ___ have been transmitted by the International Bureau.
   c. ___ have not been made; however, the time limit for making such amendments has NOT expired.
   d. X have not been made and will not be made.

8. ___ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ___ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ___ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

ITEMS 11. TO 16. BELOW CONCERN OTHER DOCUMENT(S) OR INFORMATION INCLUDED:

11. X An Information Disclosure Statement under 37 CFR 1.97 and 1.98 and 5 references.

12. X An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
    ASSIGNEE NAME AND ADDRESS: ***KABUSHIKI KAISHA YASKAWA DENKI, Kitakyushu-shi, Japan***
    Please publish the assignee data with the application.

13. X A **FIRST** preliminary amendment.

14. ___ A substitute specification.

15. ___ A change of power of attorney and/or address letter.

16. X Other items or information: 3 sheets of drawings.

ATTORNEY'S DOCKET NO: **020312**

U.S. APPLICATION NO. (if known) 10/088094	INTERNATIONAL APPLICATION NO. **PCT/JP00/06004**	DATE:

17. X The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO: $890.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) $710.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) $740.00		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO $1040.00		
International preliminary examination fee (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$ 890.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than __ 20 x 30 months from the earliest claimed priority date (37 DVR 1.492(e)).	**$ 130.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
TOTAL	4 -20 =		X $ 18.00		
INDEPENDENT	2 - 3 =		X $ 84.00		
Multiple dependent claims(s) (if applicable)			+ $280.00		
TOTAL OF ABOVE CALCULATIONS =				**$1,020.00**	
Reduction by 1/2 for filing by small entity, if applicable. (Note 37 CFR 1.9, 1.27, 1.28).					
SUBTOTAL =				**$1,020.00**	
Processing fee of **$130.00** for furnishing the English translation later than __ 20 __ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					
TOTAL NATIONAL FEE =				**$1,020.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00 per property +**				**$ 40.00**	
TOTAL FEES ENCLOSED =				**$1,060.00**	
				Amount to be: refunded	**$**
				charged	**$**

ATTORNEY'S DOCKET NO: **020312**

U.S. APPLICATION NO. (if known) 10/088094	INTERNATIONAL APPLICATION NO. **PCT/JP00/06004**	DATE: **March 21, 2002**

a. X A check in the amount of $1,060.00 to cover the above fees is enclosed. ($890.00 for basic filing fee; $130.00 for late filing of the declaration and $40.00 for assignment recordation fee). (This paper is filed in triplicate)

b. ___ Please charge my Deposit Account No. 01-2340 in the amount of $___ to cover the above fees. (A duplicate copy of this sheet is enclosed.)

c. X The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-2340.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed to request that the application be restored to pending status.

Send All Correspondence To:

23850
PATENT TRADEMARK OFFICE

SIGNATURE

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32,861
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Youichi HAHSIMOTO**

Serial No.: **Not Yet Assigned**
(§371 of international application No. PCT/JP00/06004)

Filed: **March 21, 2002**

For: **DYNAMIC OPTIMIZING METHOD FOR SPEED DATA AND POSITIONING DEVICE USING THIS METHOD**

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

March 21, 2002

Sir:

Prior to the calculation of the filing fees of the above application, please amend the application as follows:

IN THE ABSTRACT OF THE DISCLOSURE:

Please add the Abstract of the Disclosure as shown on a separate page attached hereto.

Youichi HASHIMOTO

Docket No. 020312

REMARKS

In the event there are any additional fees required, please charge our Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, WESTERMAN & HATTORI, LLP

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Reg. No. 32,861

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Youichi HASHIMOTO Docket No. 020312

ABSTRACT OF THE DISCLOSURE

A dynamic optimization method for speed data, for compensating for a speed data maximum value and a minimum resolution that can be specified by users without depending on a speed pattern preparation cycle. A dynamic optimizing method for speed data used for preparing a speed instruction pattern fed to a servo motor in a positioning device, wherein a speed pattern generator (1) that calculates a desired speed pattern when a moving instruction (2) such as a moving distance, speed, acceleration time and deceleration time is input is provided, and a speed pattern preparation cycle (3) can be specified by users without the possibility that speed data maximum value and a minimum resolution of speed data are modified.

3/parts

DESCRIPTION

DYNAMIC OPTIMIZING METHOD FOR SPEED DATA AND POSITIONING DEVICE USING THIS METHOD

Technical Field

The present invention relates to a method for preparing a speed instruction pattern for a servo motor in a positioning device.

Background Art

Conventionally, to prepare a speed pattern in a positioning device (CPU, controllers, servo amplifiers, and the like), the speed pattern preparation cycle and speed data are set as shown in Figs. 3, that is, speed data is set to 32 bits in both Fig. 3(a) and Fig. 3(b), and by means of the fixed decimal mode, 16 bits are set for the integer part and 16 bits are set for the decimal part to fix the decimal point position. The speed pattern preparation cycle as a cycle for outputting speed data is set to 8m sec in the case of Fig. 3(a) and 64m sec in the case of Fig. 3(b).

In the case of Fig. 3(a), the speed data maximum value is 245752500 (unit: min) and the minimum resolution is 0.11

(unit: min), on the other hand, in Fig. 3(b), the speed lowers and the resolution increases to a degree at which the speed data maximum value is 30719062 (unit: min) and the minimum resolution is 0.014 (unit: min).

Thus, the speed minimum resolution to be used inside the a positioning device has conventionally been set to a fixed value of 0.11 (unit: min) in Fig. 3(a) and 0.014 (unit: min) in Fig. 3(b) based on a speed pattern preparation cycle, speed unit specified by a user, and speed data maximum value specified by the user.

However, in the abovementioned conventional example, the larger the speed data maximum value, the larger the minimum resolution, and the smaller the minimum resolution, the smaller the speed data maximum value. Therefore, when the speed pattern preparation period of the positioning device is changed, the minimum resolution changes, and when the speed resolution becomes insufficient due to the speed unit specified by a user and speed data maximum value specified by the user, the speed data maximum value is limited.

Therefore, an object of the invention is to provide a dynamic optimizing method for speed data, which does not fix the resolution of speed data to be used inside a positioning device, but distinguishes a dynamic optimum resolution, and

in accordance with various speed pattern preparation cycles, user specified speed units, and speed data maximum values and minimum resolutions, can provide an environment which guarantees constant accuracy in a speed pattern determined by the user.

Furthermore, another object of the invention is to provide a positioning device using this method.

Disclosure of Invention

In order to solve the abovementioned problem, the present invention provides a dynamic optimizing method for speed data used for preparing a speed instruction pattern fed to a servo motor in a positioning device, characterized in that a speed pattern generator is provided, which calculates a desired speed pattern when a moving distance, speed, acceleration time, and deceleration time are inputted, a speed pattern preparation cycle can be specified by a user without a possibility that the speed data maximum value and minimum resolution of the speed data are modified.

According to a first aspect of the invention, the dynamic optimizing method for speed data is characterized in that a combination of a speed data maximum value and a minimum resolution can be selected by a user.

In addition, when a user specifies the speed pattern preparation cycle, the speed data maximum value and minimum resolution are prevented from changing by shifting the decimal part of the speed data to the right or left.

Furthermore, a positioning device using a servo motor comprises a moving instruction input unit, a speed pattern preparation unit for inputting a moving instruction from this moving instruction input unit, a speed instruction unit for outputting a speed instruction based on a speed instruction pattern from the speed pattern preparation unit in accordance with the speed instruction cycle specified by a user, and a servo control unit for driving the servo motor based on the speed instruction from this speed instruction unit.

According to this dynamic optimizing method for speed data, even when the speed pattern preparation cycle is dynamically changed, the speed data maximum value and minimum resolution are not influenced by this change, so that it becomes unnecessary to change a user program even when a user changes the speed pattern preparation cycle.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a conceptual diagram of program execution processing of a positioning device relating to an embodiment

of the invention;

Figs. 2 are drawings showing speed data prepared by the speed pattern preparation unit of Fig. 1; and

Figs. 3 are drawings showing conventional speed data.

Best Mode for Carrying Out the Invention

Hereinafter, an embodiment of the invention is explained with reference to the drawings.

In Fig. 1, the speed pattern preparation unit 1 is a controller comprising a CPU module and a motion module for a positioning device. The moving instruction 2 is to be inputted into the speed pattern preparation unit 1, and includes a speed, moving distance, and acceleration and deceleration constant (S-shaped pattern). The speed pattern preparation cycle 3 indicates a cycle (scanning cycle 8ms through 64ms) of a speed instruction outputted by the positioning device, and is specified by a user. The computation result 4 (speed instruction unit) is based on the speed pattern preparation unit 1, and outputs a speed instruction in each cycle based on the prepared speed pattern. The servo control unit 5 drives the servo motor 6 based on the speed instruction, and controls the motor position and speed.

Next, operations are explained.

The speed pattern preparation unit 1 calculates a speed pattern based on the inputted speed pattern preparation cycle 3 and moving instruction (moving distance and acceleration and deceleration time) 2, and the size of the computing range in this case is set to have a fixed length inside the positioning device. In this computing range with a fixed length, as shown in Figs. 2, when speed data is held in the fixed decimal mode, the size of speed data is fixed to a size of 16 bits, 32 bits, or 64 bits. Figs. 2 show an example in which the speed data size is 32 bits.

The fixed decimal mode is characterized in that the sum of significant digits of the integer part and significant digits of the decimal part from the fixed decimal point position are always fixed, so that under the same speed pattern preparation cycle condition, if the integer part is taken to be large, the decimal part becomes small, and the resolution lowers. On the contrary, if the decimal part is taken to be large, the integer part becomes small, and the integer output range is reduced.

When the speed pattern preparation cycle 3 is fixed, for example, as shown in Fig. 2(a) and Fig. 3(a), and when the speed pattern preparation cycle 3 is 8ms and the speed is the same, that is, the speed is constant, the integer part and decimal part can be fixed at an optimum ratio, for example, an integer

part is fixed to be 16 bits and the decimal part is fixed to be 16 bits. However, when the speed pattern preparation cycle is dynamically changed, if the ratio of the integer part and the decimal part is fixed, the speed pattern preparation cycle influences the speed pattern resolution and speed data maximum value, so that it is necessary to modify the user program for each change in the speed pattern preparation cycle. That is, in the example of Figs. 3, when the speed pattern preparation cycle changes from 8ms to 64ms as shown in Fig. 3(b), it is necessary to modify the program based on the corresponding ratio of the speed data maximum value and minimum resolution of Fig. 3(a).

Therefore, the invention is constructed so that, as shown in Fig. 2(b), even when the speed pattern preparation cycle 3 is changed to 64ms, the decimal part is shifted to the right to prevent the integer part of 19 bits, decimal part of 13 bits, speed data maximum value, and minimum resolution from changing, wherein by shifting the decimal part to the right or left, even when the speed pattern preparation cycle is changed, the speed data maximum value and minimum resolution do not change, and this makes modification of the user program unnecessary.

Furthermore, this combination of the speed data maximum value and minimum resolution is arranged so as to be set when

inputting the moving instruction 2 and selected by a user, the positioning device shifts the decimal part of the speed data in accordance with the speed pattern preparation cycle so as to prevent the specified inputted speed data maximum value and minimum resolution from changing, so that a user can select an optimum data holding method, and can efficiently utilize controller resources in program preparation, look-ahead, and analysis.

Comparison with the floating decimal mode in which the decimal point position is variable makes no sense since the fixed decimal mode and floating decimal mode are different from each other in data structure and characteristics.

As described above, according to the invention, a dynamic optimizing method for speed data used for preparing a speed instruction pattern fed to a servo motor in a positioning device is characterized in that a speed pattern generator for calculating a desired speed pattern when a moving distance, speed, acceleration time, and deceleration time are inputted, the speed pattern preparation cycle can be specified by a user without a possibility of modifying the speed data maximum value and minimum resolution of the speed data. Therefore, even when the speed pattern preparation cycle is changed, compensation is carried out so as to prevent the speed data maximum value

and minimum resolution of the speed data from changing, the combination of the speed data maximum value and minimum resolution can be selected by a user, and furthermore, when a user specifies the speed pattern preparation cycle, by shifting the decimal part of the speed data to the right or left, the speed data maximum value and minimum resolution can be prevented from changing. Accordingly, it is unnecessary for a user to modify the user program even when the user changes the speed pattern preparation cycle.

Industrial Applicability

The invention provides a positioning control device which a user can easily operate. Furthermore, this device is extremely effective for control of a linear motor which requires a high feeding speed and highly accurate positioning.

WHAT IS CLAIMED IS:

1. A dynamic optimizing method for speed data used for preparing a speed instruction pattern fed to a servo motor in a positioning device, wherein

a speed pattern generator for calculating a desired speed pattern when a moving distance, speed, acceleration time and deceleration time are inputted is provided, and the speed pattern preparation cycle is allowed to be specified by a user without a possibility that the speed data maximum value and minimum resolution of the speed data are changed.

2. The dynamic optimizing method for speed data according to Claim 1, wherein a combination of the speed data maximum value and minimum resolution is allowed to be selected by a user.

3. The dynamic optimizing method for speed data according to Claim 1, wherein when a user specifies the speed pattern preparation cycle, the decimal part of the speed data is shifted to the right or left so as to prevent the speed data maximum value and minimum resolution from being changed.

4. A positioning device using a servo motor, comprising: a moving instruction input unit, a speed pattern preparation unit for inputting a moving instruction from the moving instruction input unit, a speed instruction unit for outputting

a speed instruction based on the speed instruction pattern from the speed pattern preparation unit in accordance with the speed instruction cycle specified by a user, and a servo control unit for driving the servo motor based on the speed instruction from the speed instruction unit.

特許協力条約に基づいて公開された国際出

(19) 世界知的所有権機関
国際事務局

(43) 国際公開日
2001 年3 月29 日 (29.03.2001)

PCT

(10) 国際公開番号
WO 01/22184 A1

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(22) 国際出願日: 2000 年9 月4 日 (04.09.2000)

(25) 国際出願の言語: 日本語

(26) 国際公開の言語: 日本語

(30) 優先権データ:
特願平11/267547 1999 年9 月21 日 (21.09.1999) JP

(71) 出願人 (米国を除く全ての指定国について): 株式会社安川電機 (KABUSHIKI KAISHA YASKAWA DENKI) [JP/JP]; 〒806-0004 福岡県北九州市八幡西区黒崎城石2番1号 Fukuoka (JP).

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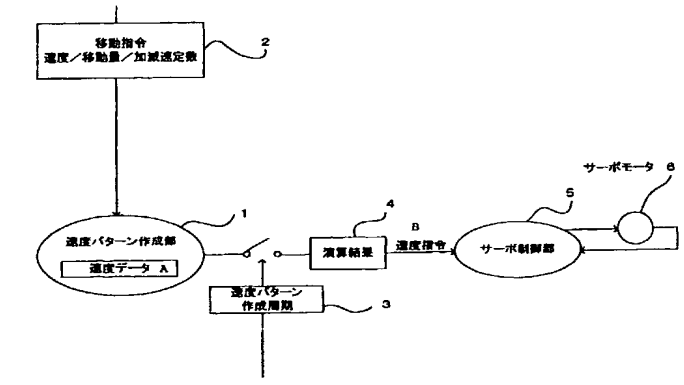
(81) 指定国 (国内): US.

(84) 指定国 (広域): ヨーロッパ特許 (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

添付公開書類:
— 国際調査報告書

(54) Title: DYNAMIC OPTIMIZING METHOD FOR SPEED DATA AND POSITIONING DEVICE USING THIS METHOD

(54) 発明の名称: 速度データの動的最適化方法およびこの方法を用いた位置決め装置



2...MOVING INSTRUCTION
SPEED/MOVING DISTANCE/ACCELERATION DECELERATION CONSTANS
1...SPEED PATTERN PREPARATION UNIT
A...SPEED DATA
3...SPEED PATTERN PREPARATION CYCLE
4...COMPUTATION RESULT
B...SPEED INSTRUCTION
5...SERVO CONTROL UNIT
6...SERVO MOTOR

(57) Abstract: A dynamic optimization method for speed data, for compensating for a speed data maximum value and a minimum resolution that can be specified by users without depending on a speed pattern preparation cycle. A dynamic optimizing method for speed data used for preparing a speed instruction pattern fed to a servo motor in a positioning device, wherein a speed pattern generator (1) that calculates a desired speed pattern when a moving instruction (2) such as a moving distance, speed, acceleration time and deceleration time is input is provided, and a speed pattern preparation cycle (3) can be specified by users without the possibility that a speed data maximum value and a minimum resolution of speed data are modified.

[続葉有]

WO 01/22184 A1

Fig. 1

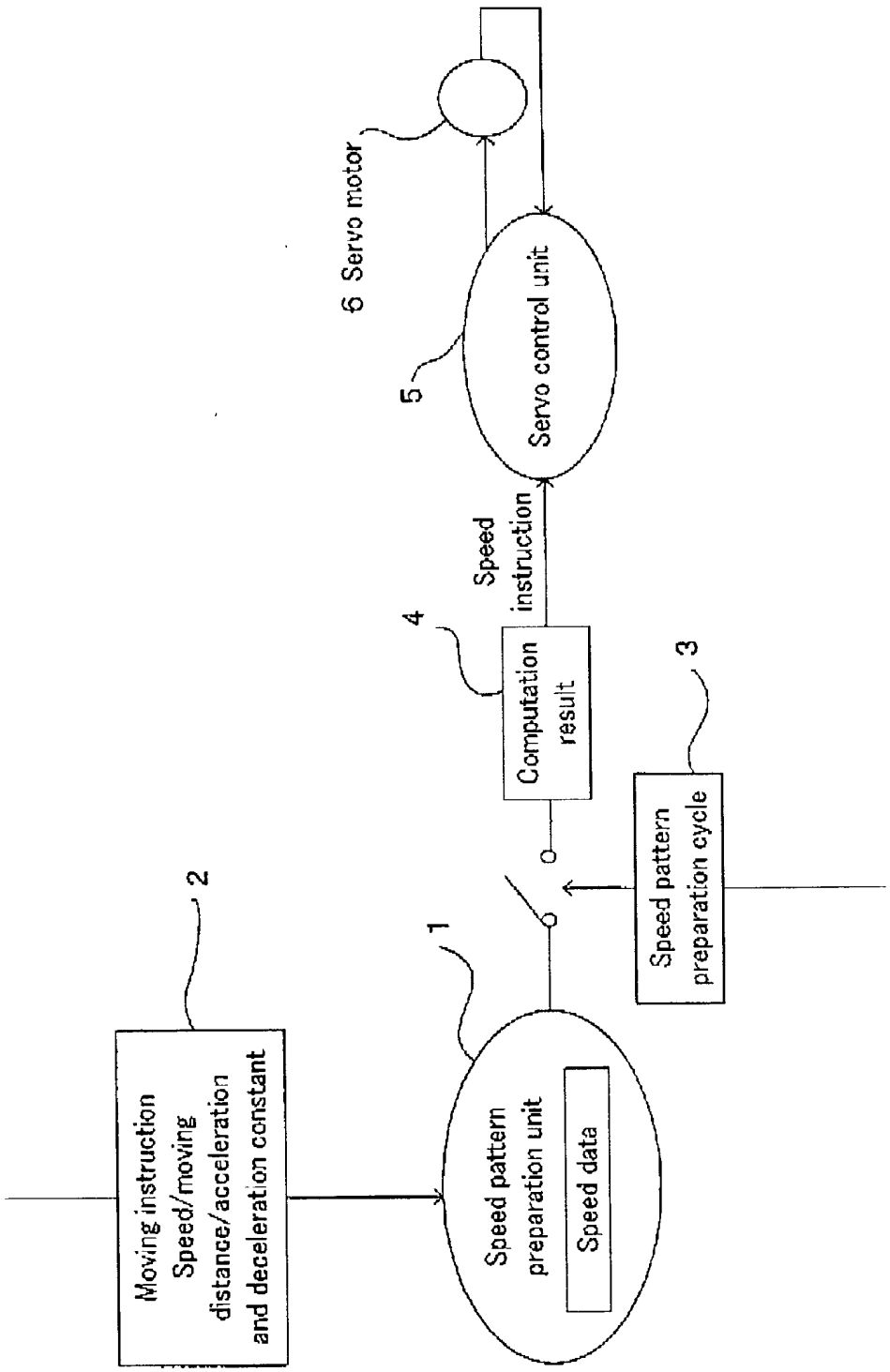

Moving instruction
Speed/moving distance/acceleration and deceleration constant
2
Speed pattern preparation unit
Speed data
1
Speed pattern preparation cycle
3
Computation result
4
Speed instruction
Servo control unit
5
6 Servo motor

Fig. 2(a) When the speed pattern preparation cycle is 8m sec:

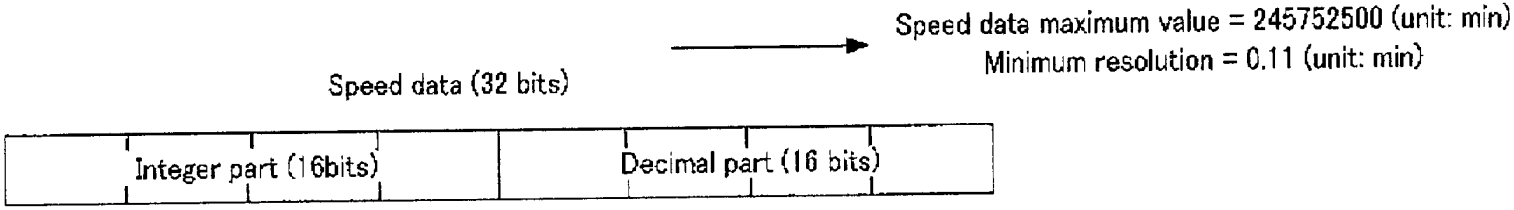


Fig. 2(b) When the speed pattern preparation cycle is 64m sec:

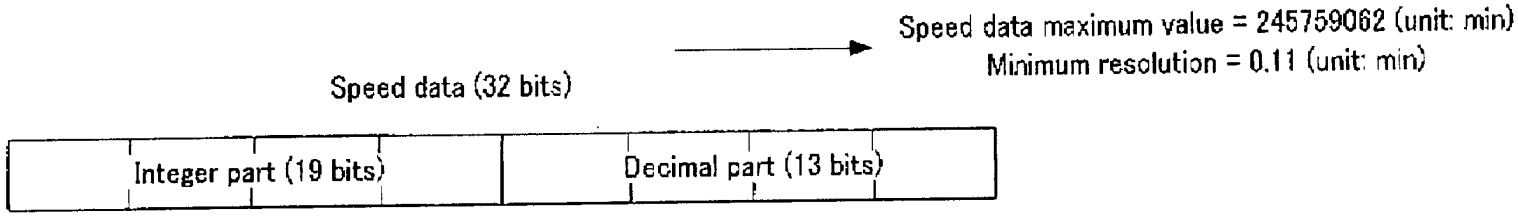


Fig. 3(a) When the speed pattern preparation cycle is 8m sec.

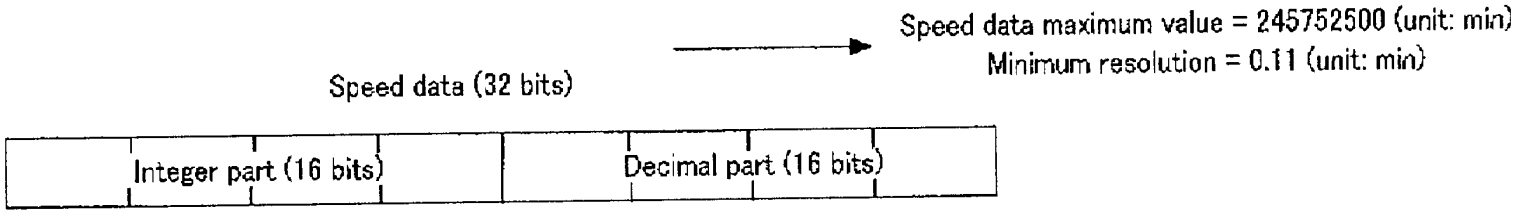
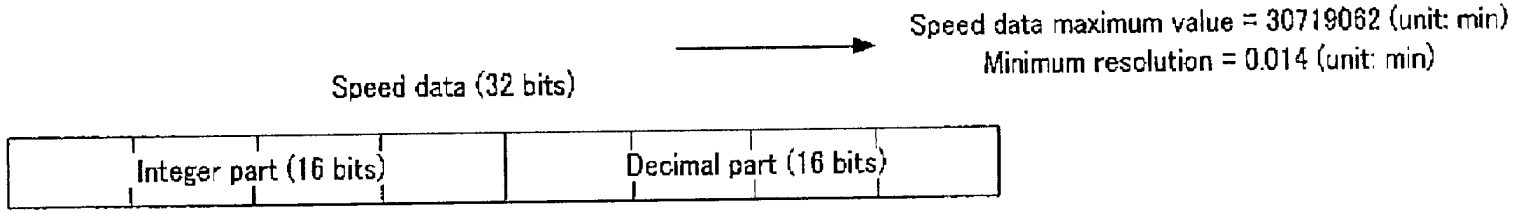


Fig. 3(b) When the speed pattern preparation cycle is 64m sec.



#4

Docket No.

Armstrong, Westerman & Hattori, LLP

DECLARATION FOR U.S. PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention **entitled**

DYNAMIC OPTIMIZATION METHOD FOR SPEED DATA AND POSITIONING DEVICE USING THIS METHOD

the specification of which is attached hereto unless the following is checked

☒ was filed on **September 4, 2000** as United States Application Number _____ or PCT International Application Number **PCT/JP00/06004** and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 (a) – (d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application for which priority is claimed.

(List prior foreign applications. See note A on back of this page)	(Number)	(Country)	(Day/Month/Year Filed)	Priority Claimed
	11-267547	JAPAN	21/09/1999	☒ Yes ☐ No
				☐ Yes ☐ No
				☐ Yes ☐ No
				☐ Yes ☐ No

(See note B on back of this page) ☐ See attached list for additional prior foreign applications

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(List prior U.S. Applications)	(Application Serial No.)	(Filing Date)	Status
			☐ Patented ☐ Pending ☐ Abandoned
			☐ Patented ☐ Pending ☐ Abandoned
			☐ Patented ☐ Pending ☐ Abandoned

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

23850

23850

PATENT TRADEMARK OFFICE

Please direct all communications to the following address:

23850

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PATENT TRADEMARK OFFICE

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18 of the United States Code, § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00 (See note C)

Full name of sole or first inventor (given name, family name) Youichi HASHIMOTO

Inventor's signature Youichi Hashimoto Date Mar. 11th, 2002

Residence Kitakyushu-shi, JAPAN JPX Citizenship JAPAN

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JAPAN

Full name of second inventor (given name, family name)

Inventor's signature Date

Residence Citizenship

Post Office Address

Full name of third inventor (given name, family name)

Inventor's signature Date

Residence Citizenship

Post Office Address

Full name of fourth inventor (given name, family name)

Inventor's signature Date

Residence Citizenship

Post Office Address

NOTES

A. Please list all foreign applications relating to the invention and check block "yes" or "no".

B. If more than 4 prior foreign applications, please check this box and attach a sheet listing the remaining prior foreign applications.

C. For residence in the U.S., indicate city and state, for residence outside the U.S., indicate city and country. The "Post Office Address" must be an address acceptable by a Post Office for delivery of mail.